

FIG. 1

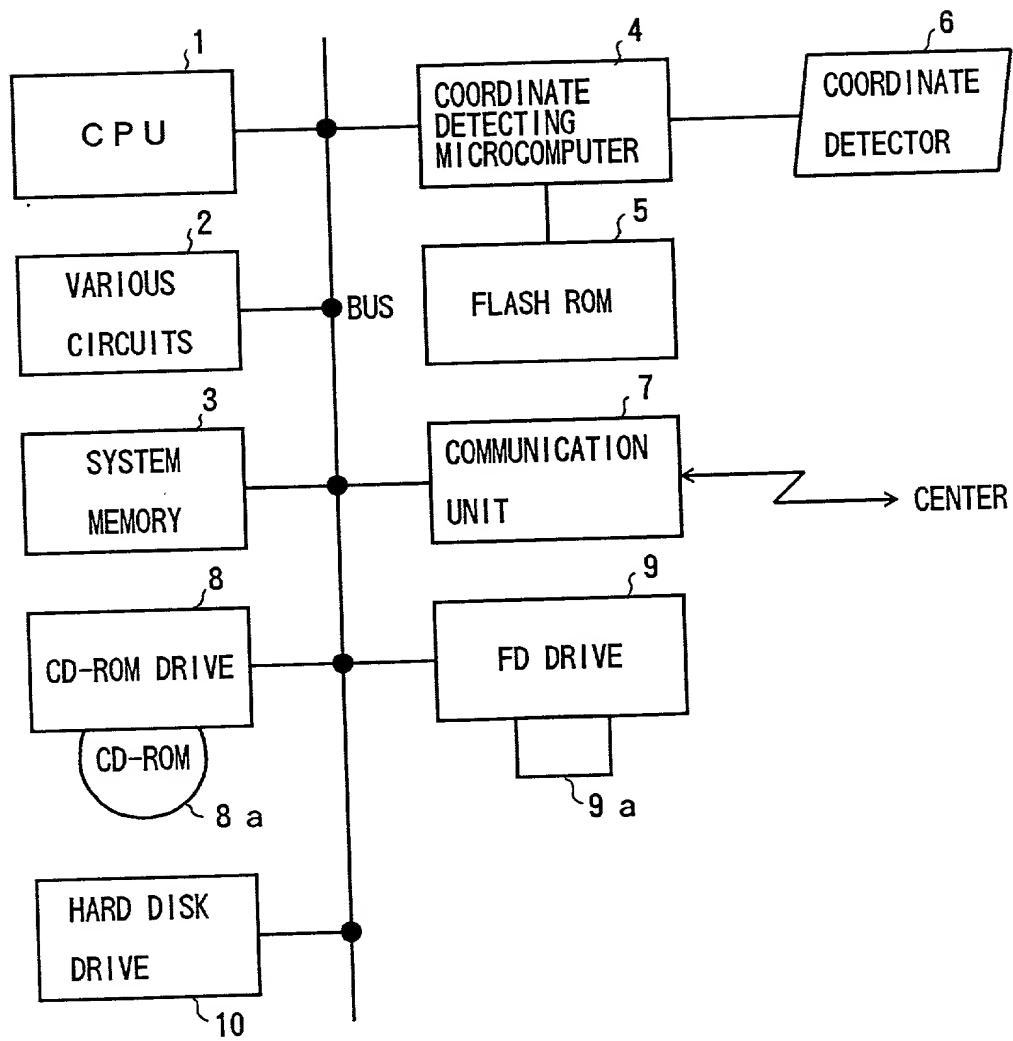


FIG. 2

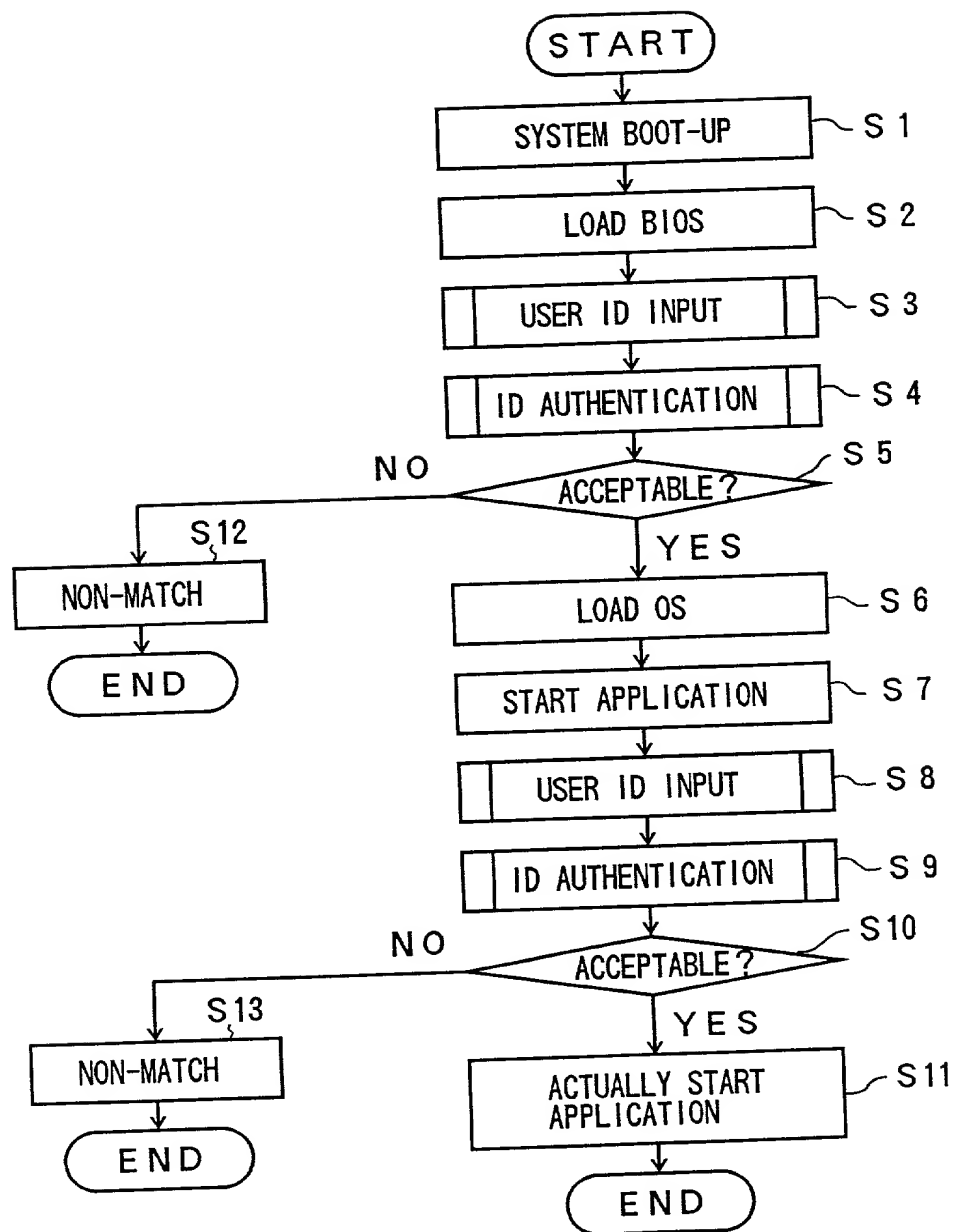


FIG. 3

SOFTWARE OF CPU 1

COORDINATE DETECTING
MICROCOMPUTER 4

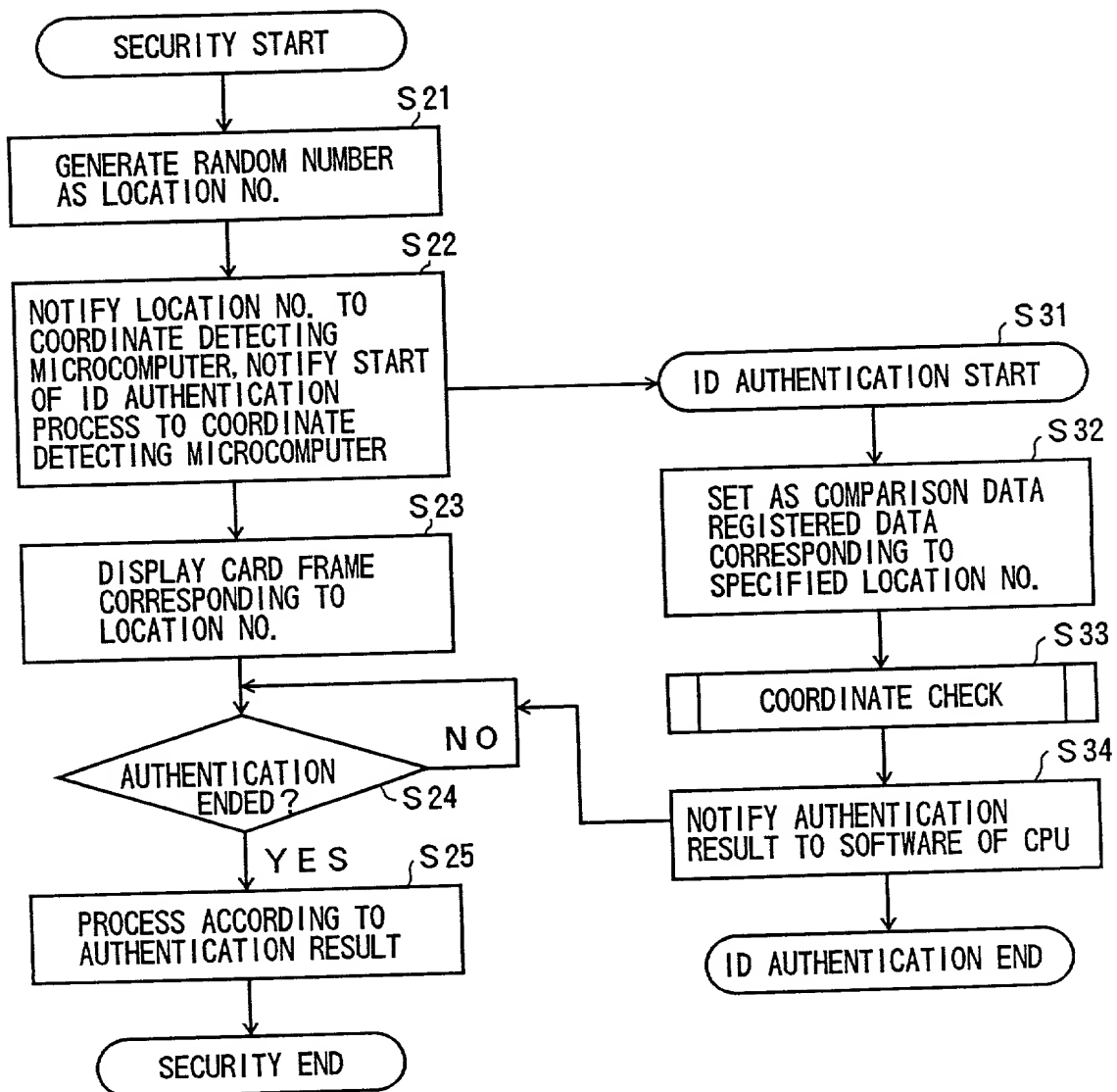


FIG. 4

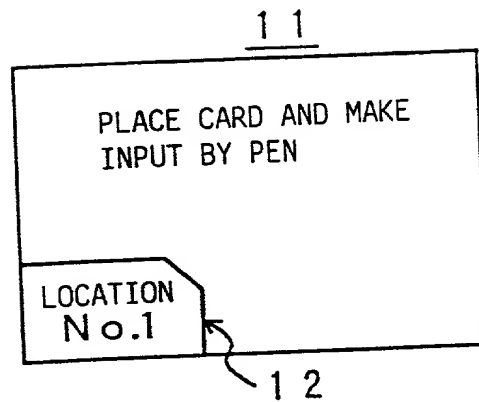


FIG. 5A

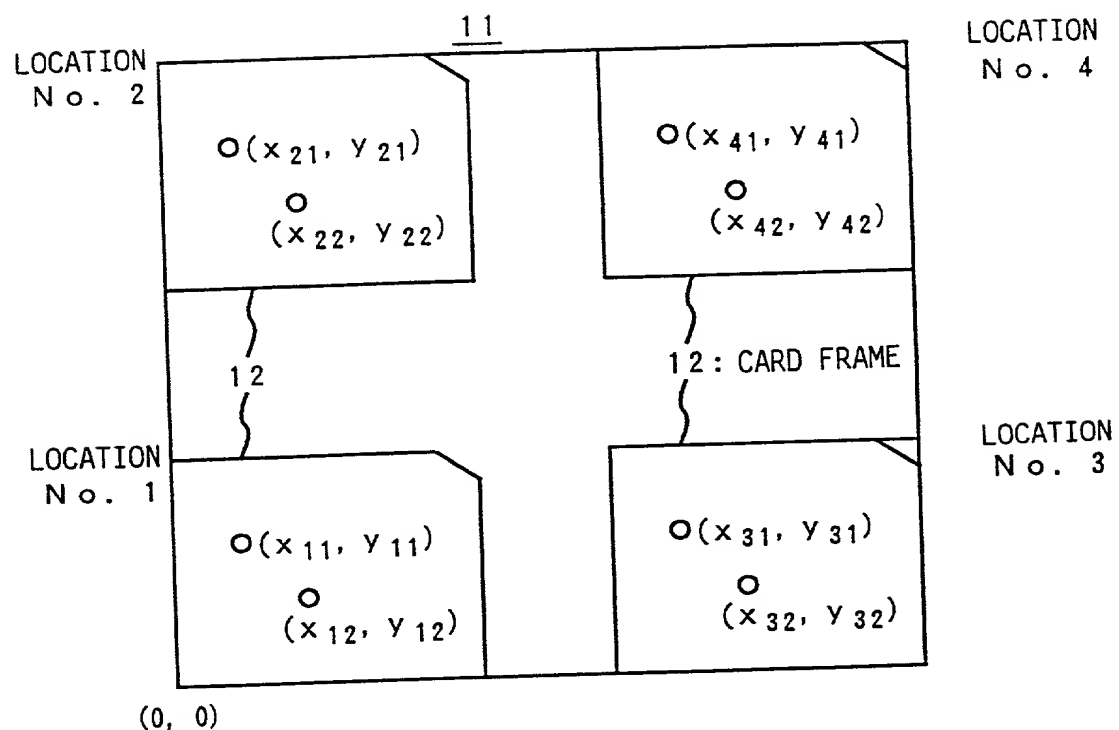


FIG. 5B

LOCATION No.	POINT No.	COORDINATE
1	1	(x_{11}, y_{11})
	2	(x_{12}, y_{12})
2	1	(x_{21}, y_{21})
	2	(x_{22}, y_{22})
3	1	(x_{31}, y_{31})
	2	(x_{32}, y_{32})
4	1	(x_{41}, y_{41})
	2	(x_{42}, y_{42})

FIG. 6A

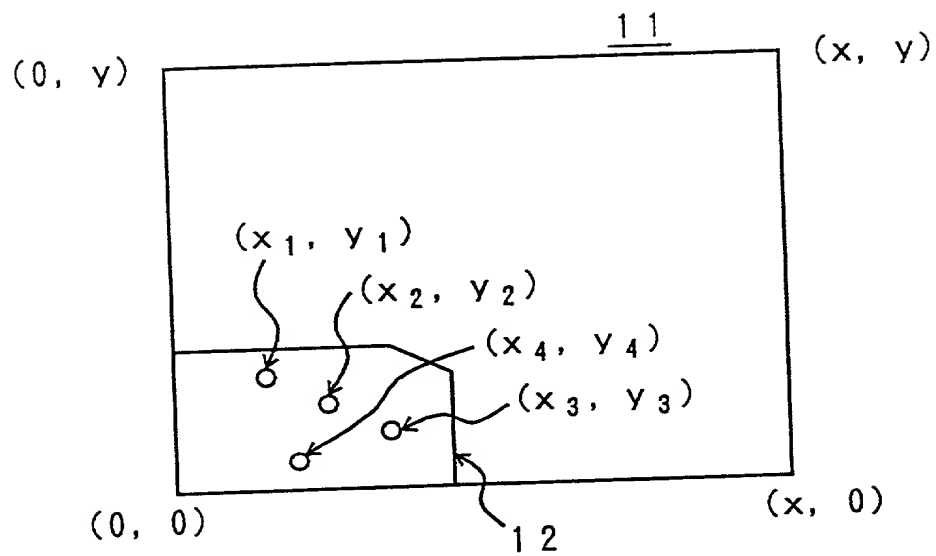


FIG. 6B

No.	COORDINATE
1	(x_1, y_1)
2	(x_2, y_2)
3	(x_3, y_3)
4	(x_4, y_4)

FIG. 7

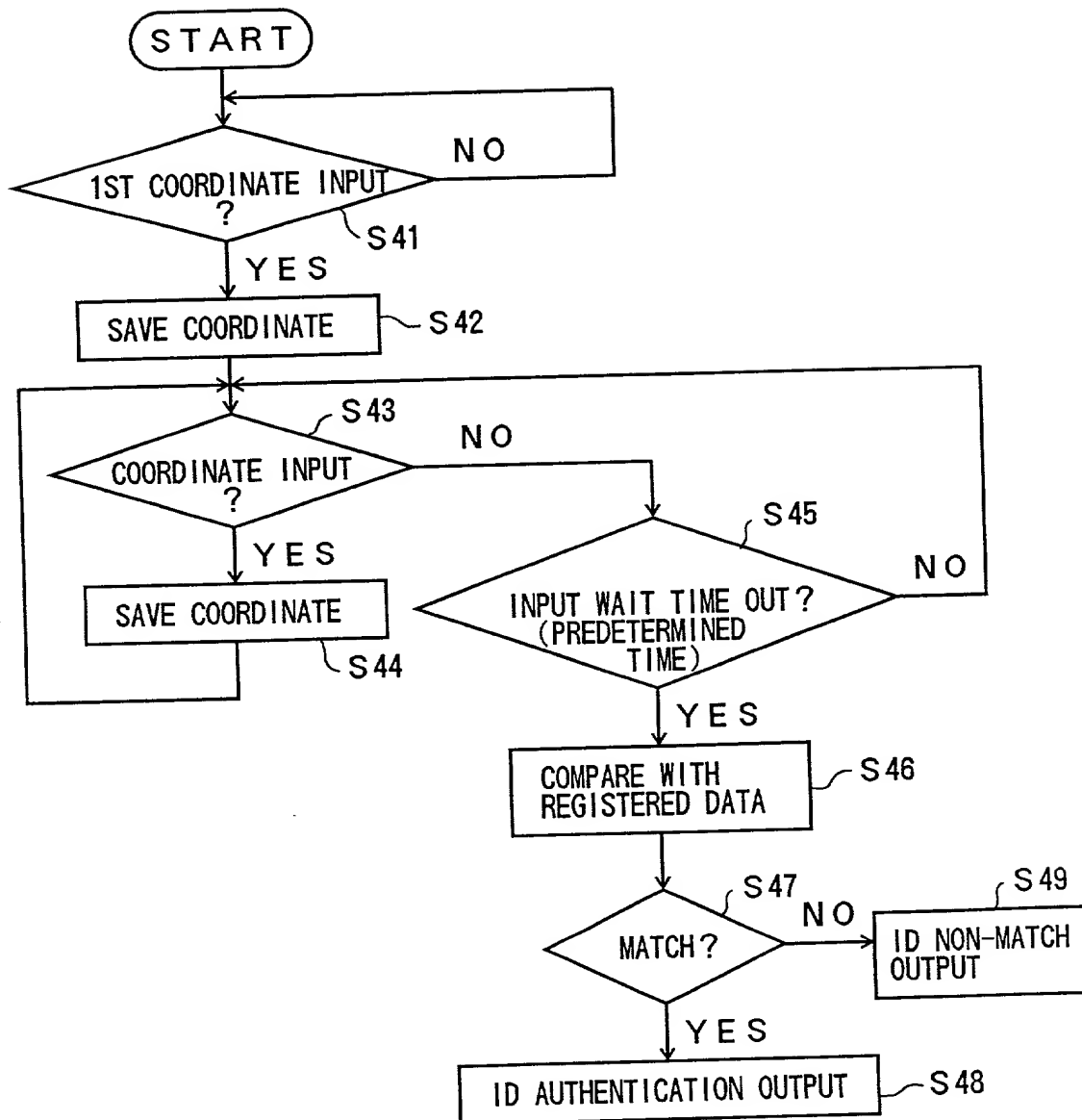


FIG. 8

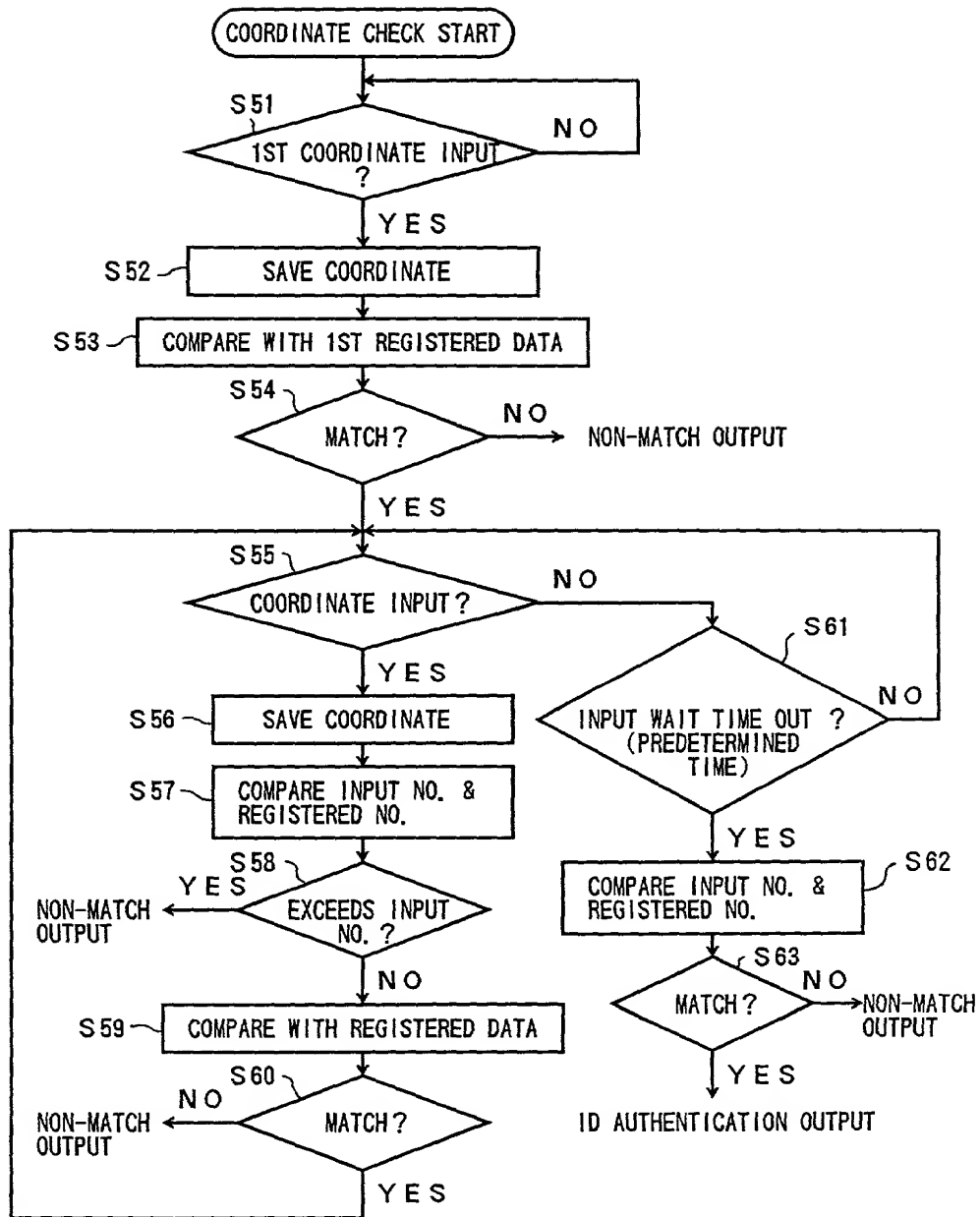


FIG. 9

SOFTWARE OF CPU 1

COORDINATE DETECTING
MICROCOMPUTER 4

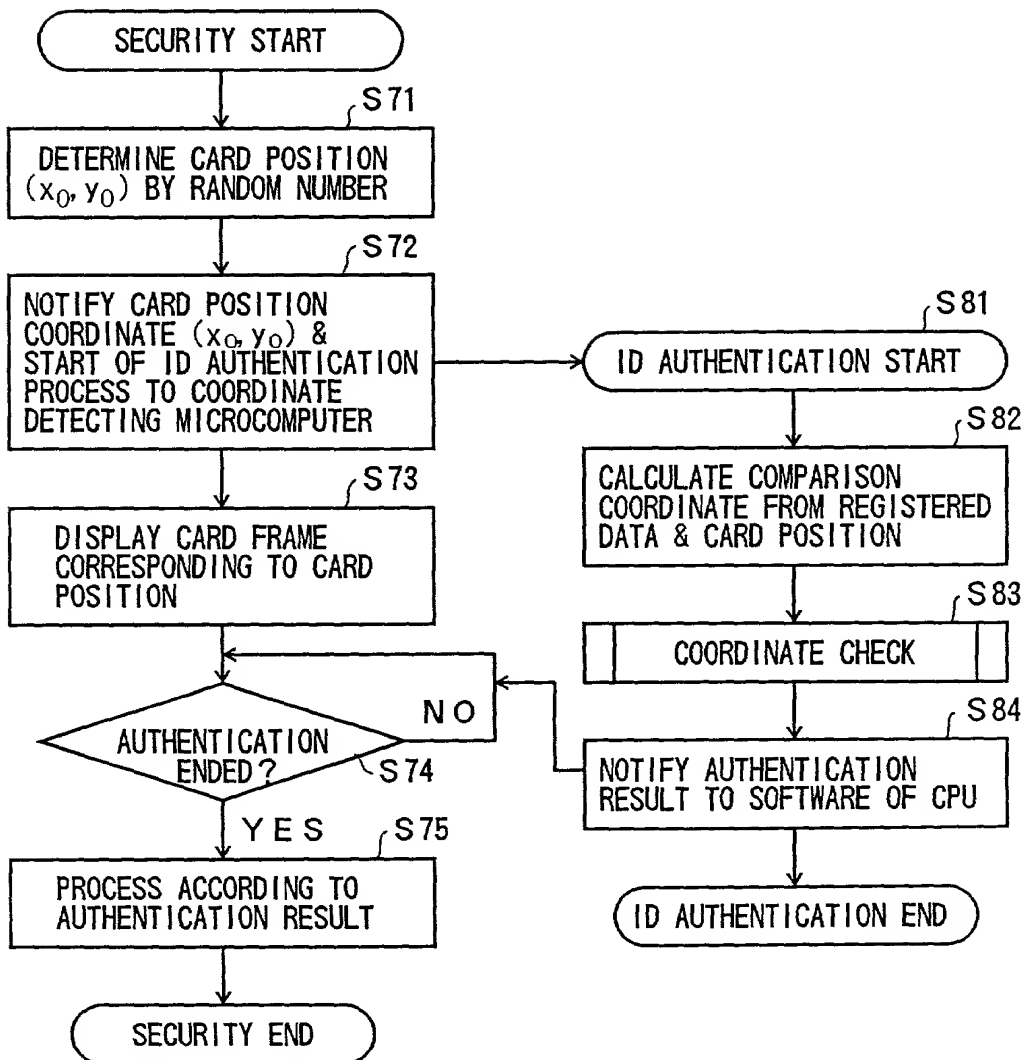


FIG. 10A

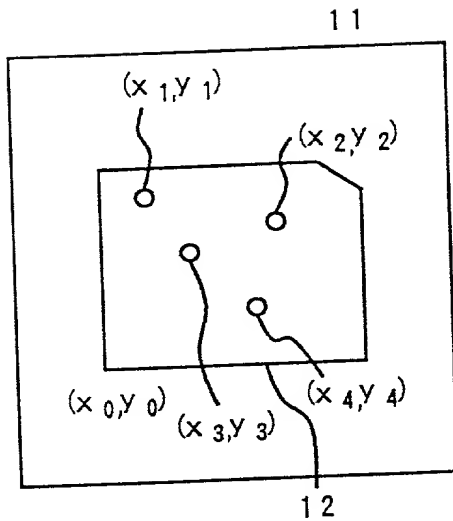


FIG. 10B

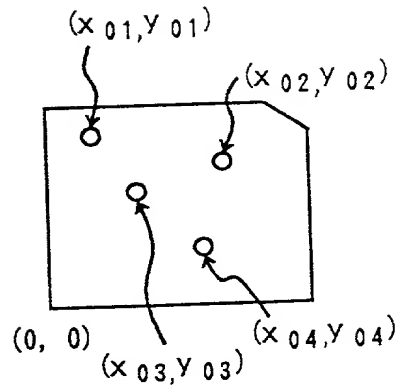


FIG. 10C

POINT No.	CARD ORIGIN	HOLE COORDINATE VALUE WITHIN CARD	COMPARISON COORDINATE
1	(x_0, y_0)	(x_{01}, y_{01})	$(x_1, y_1) = (x_0 + x_{01}, y_0 + y_{01})$
2		(x_{02}, y_{02})	$(x_2, y_2) = (x_0 + x_{02}, y_0 + y_{02})$
3		(x_{03}, y_{03})	$(x_3, y_3) = (x_0 + x_{03}, y_0 + y_{03})$
4		(x_{04}, y_{04})	$(x_4, y_4) = (x_0 + x_{04}, y_0 + y_{04})$

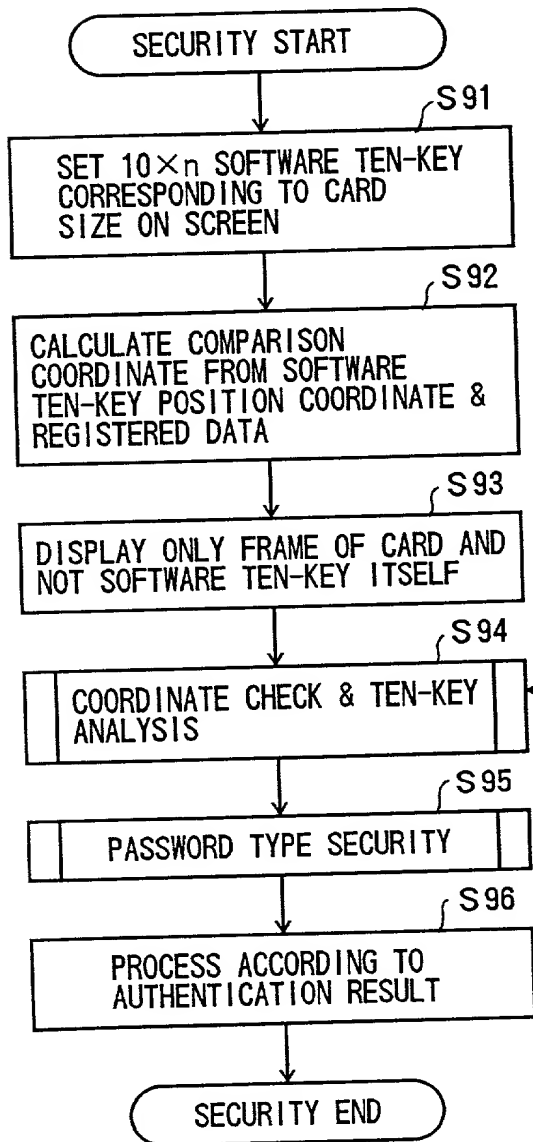
REGISTERED DATA

DATA RECEIVED FROM CPU

OBTAIN DATA FOR COMPARISON WITH ACTUALLY DETECTED COORDINATE FOR AUTHENTICATION BY CALCULATION PRIOR TO AUTHENTICATION

FIG. 11

SOFTWARE OF CPU 1



COORDINATE DETECTING MICROCOMPUTER 4

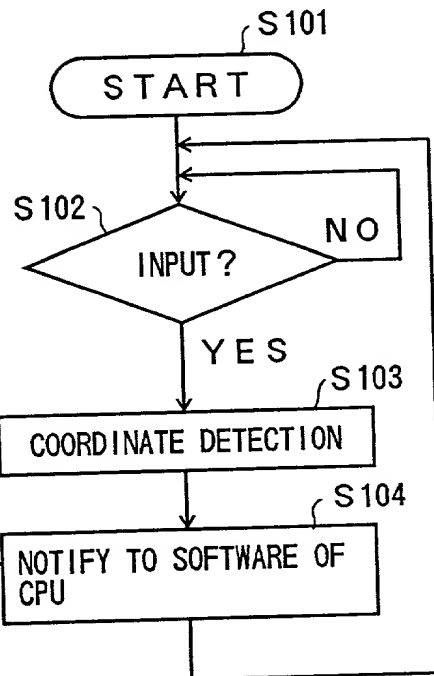
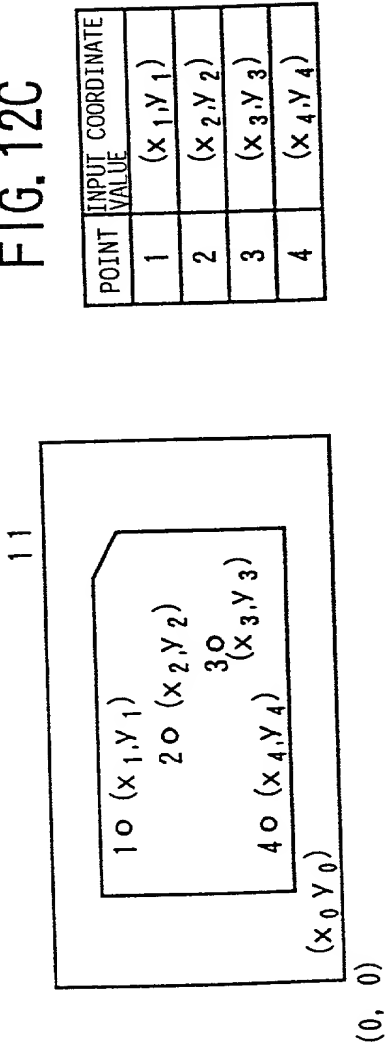


FIG. 12C



POINT	INPUT COORDINATE VALUE
1	(x ₁ , y ₁)
2	(x ₂ , y ₂)
3	(x ₃ , y ₃)
4	(x ₄ , y ₄)

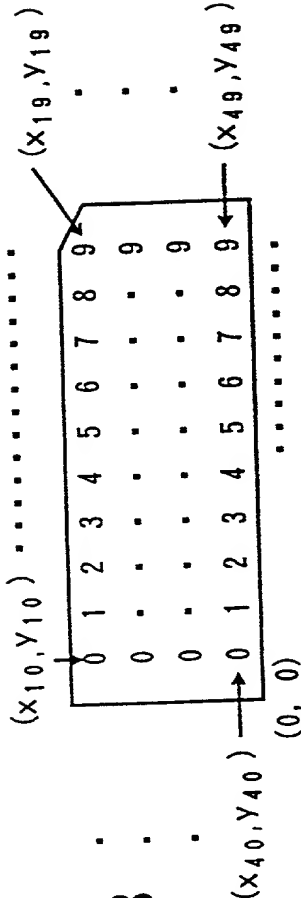


FIG. 12B

FIG. 12D

POINT No.	RECEIVED COORDINATE	ORIGIN COORDINATE OF SOFTWARE TEN-KEY	COMPARISON COORDINATE OF SOFTWARE TEN-KEY	COMPARISON RESULT	RESULT
1	(x ₁ , y ₁)	(x ₀ , y ₀)	(x ₁ ' , y ₁ ') = (x ₁ - x ₀ , y ₁ - y ₀)	(x ₁₂ , y ₁₂)	2
2	(x ₂ , y ₂)		(x ₂ ' , y ₂ ') = (x ₂ - x ₀ , y ₂ - y ₀)	(x ₂₂ , y ₂₂)	6
3	(x ₃ , y ₃)		(x ₃ ' , y ₃ ') = (x ₃ - x ₀ , y ₃ - y ₀)	(x ₃₂ , y ₃₂)	9
4	(x ₄ , y ₄)		(x ₄ ' , y ₄ ') = (x ₄ - x ₀ , y ₄ - y ₀)	(x ₄₂ , y ₄₂)	2

COMPARE WITH (x₁₀, y₁₀) ~ (x₄₀, y₄₀)

OUTPUT KEY CODE "2 6 9 2"

POINT NO.	CARD ORIGIN		COMPARISON COORDINATE OF		COMPARISON RESULT
	DETECTED COORDINATE FROM CPU		SOFTWARE TEN-KEY		
1	$(x_1 \ y_1)$	$(x_0 \ y_0)$	$(x_1' \ y_1') = (x_1 - x_0, y_1 - y_0)$	(x_{12}, y_{12})	2
2	$(x_2 \ y_2)$		$(x_2' \ y_2') = (x_2 - x_0, y_2 - y_0)$	(x_{26}, y_{26})	6
3	$(x_3 \ y_3)$		$(x_3' \ y_3') = (x_3 - x_0, y_3 - y_0)$	(x_{39}, y_{39})	9
4	$(x_4 \ y_4)$		$(x_4' \ y_4') = (x_4 - x_0, y_4 - y_0)$	(x_{42}, y_{42})	2

FIG. 13A

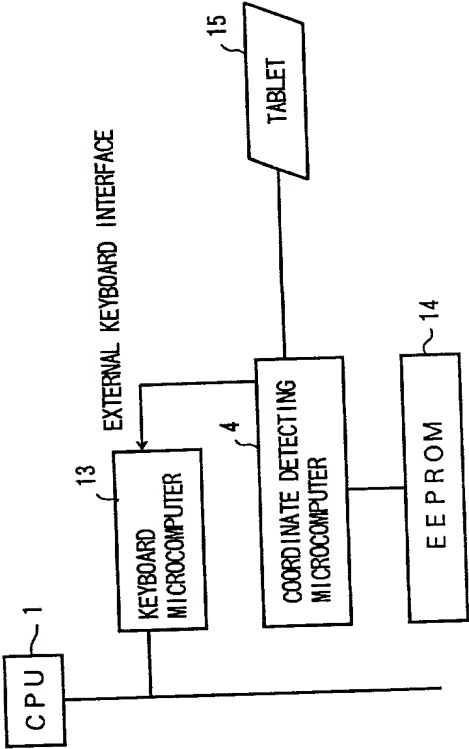


FIG. 13B

FIG. 14

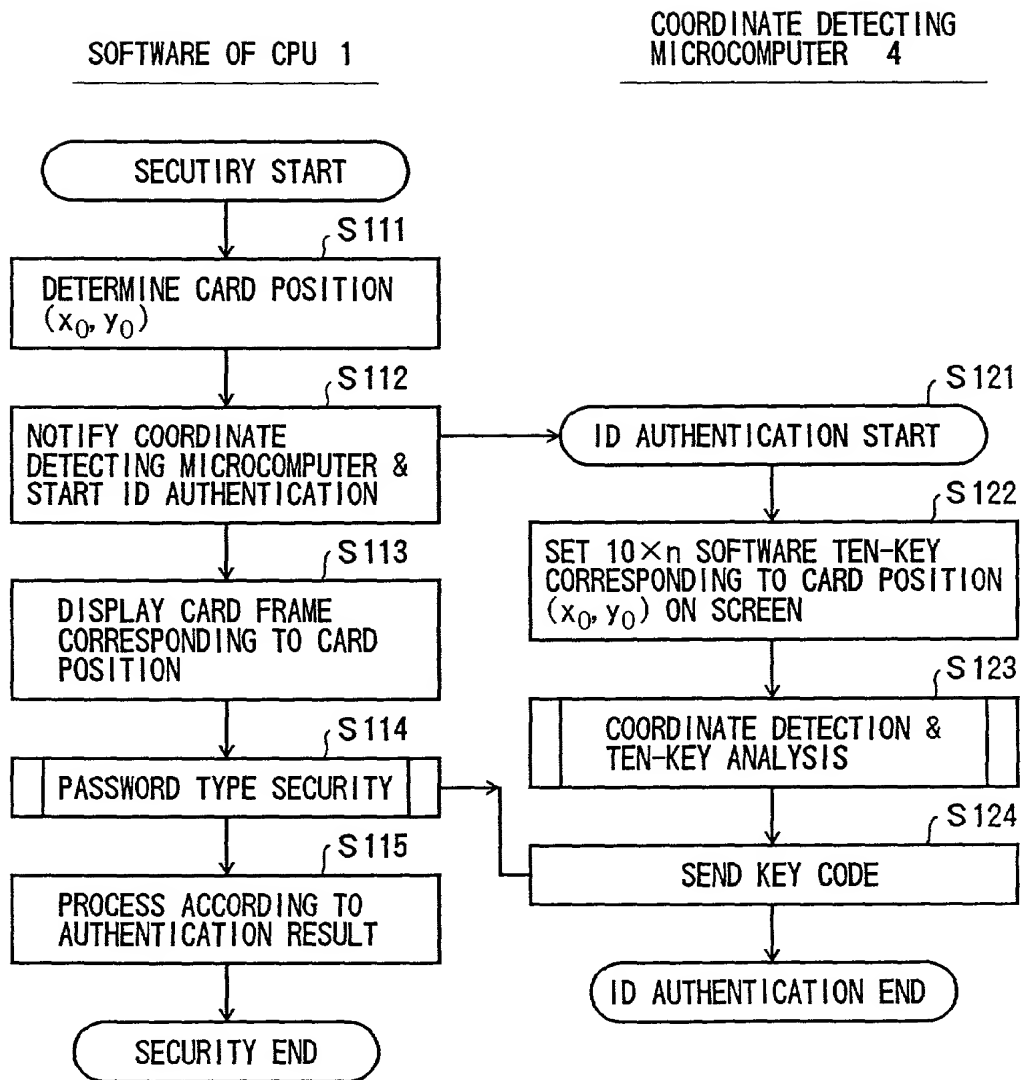


FIG. 15A

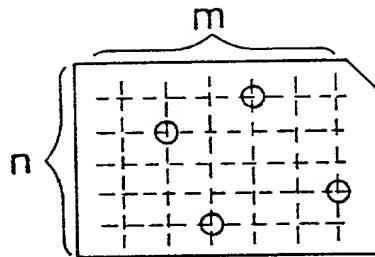


FIG. 15B

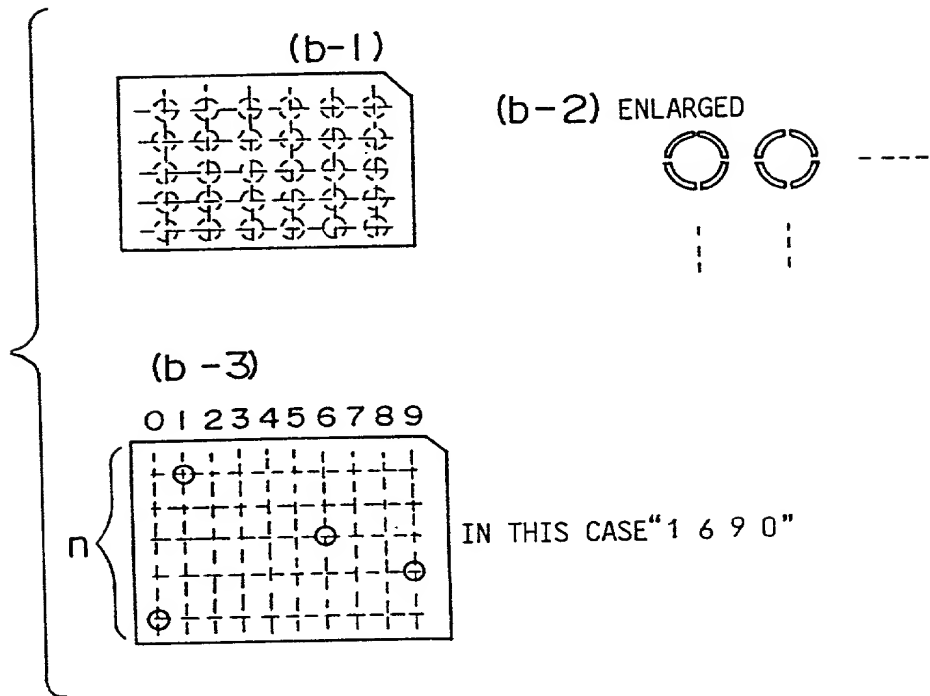


FIG. 16

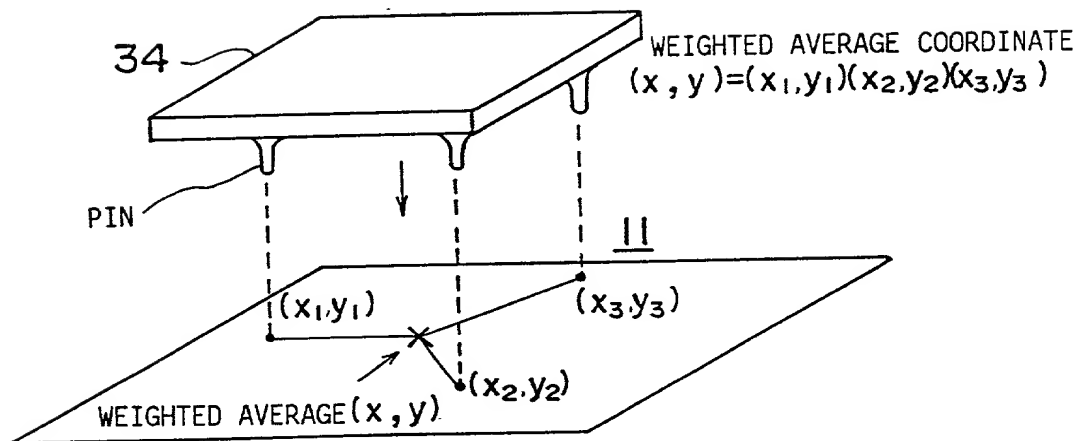


FIG. 17

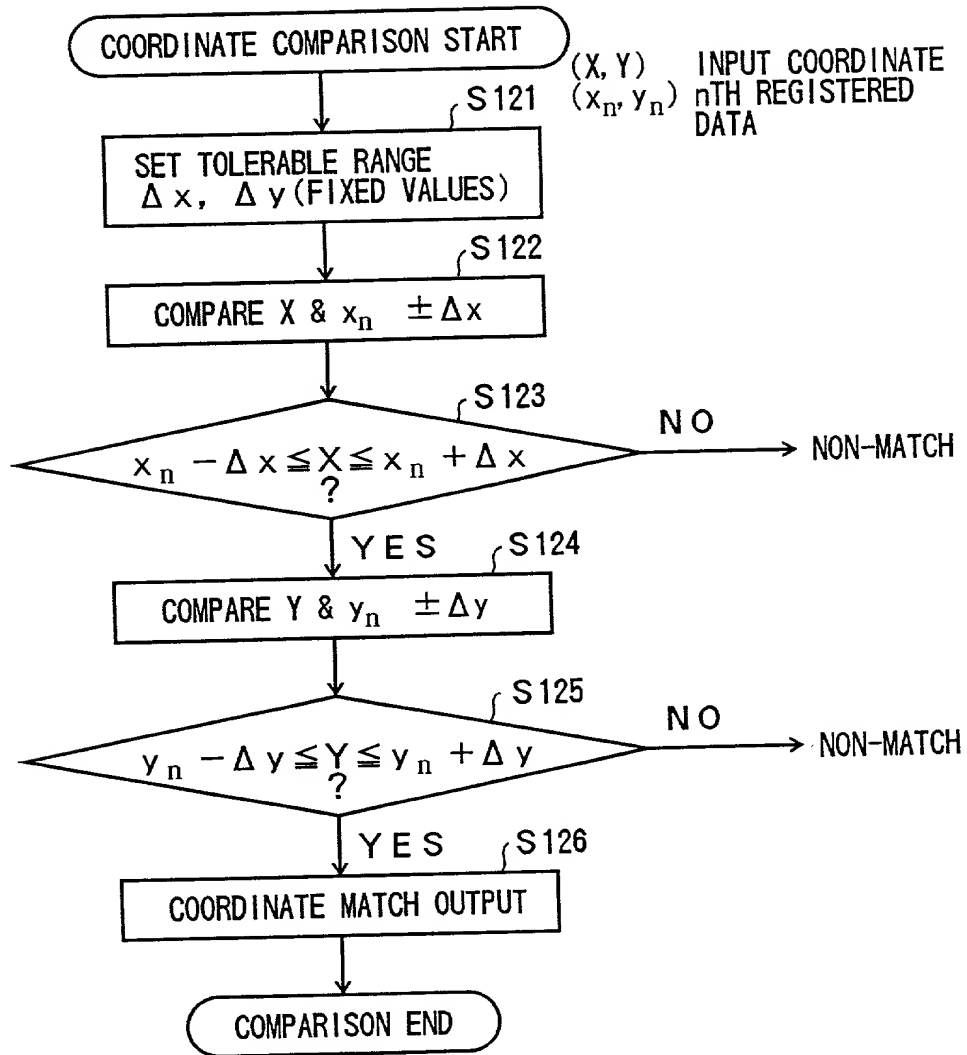


FIG. 18A

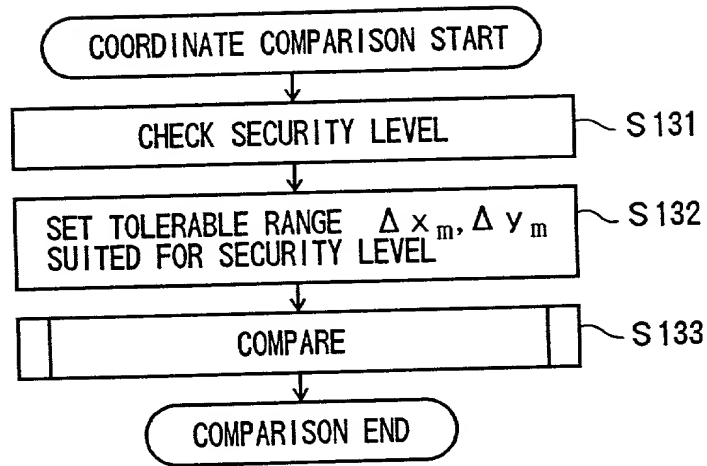


FIG. 18B

SECURITY LEVEL	TOLERABLE RANGE
1	$(\Delta x_1, \Delta y_1)$
⋮	⋮
m	$(\Delta x_m, \Delta y_m)$
⋮	⋮
ℓ	$(\Delta x_\ell, \Delta y_\ell)$

WHERE $\Delta x_1 > \dots > \Delta x_m > \dots > \Delta x_\ell$
 $\Delta y_1 > \dots > \Delta y_m > \dots > \Delta y_\ell$

FIG. 19A

POINT NO.	CARD ORIGIN	REGISTERED DATA OF HOLE COORDINATES WITHIN CARD	COMPARISON COORDINATE RANGE	
			min	
1	(x ₀ y ₀) TOLERABLE RANGE (Δ x ₀ , Δ y ₀)	(x ₀₁ y ₀₁)	(x ₀ - Δ x ₀ + x ₀₁ , y ₀ - Δ y ₀ + y ₀₁)	
2		(x ₀₂ y ₀₂)	(x ₀ - Δ x ₀ + x ₀₂ , y ₀ - Δ y ₀ + y ₀₂)	
3		(x ₀₃ y ₀₃)	(x ₀ - Δ x ₀ + x ₀₃ , y ₀ - Δ y ₀ + y ₀₃)	
4		(x ₀₄ y ₀₄)	(x ₀ - Δ x ₀ + x ₀₄ , y ₀ - Δ y ₀ + y ₀₄)	

FIG. 19B

max	
(x ₀ + Δ x ₀ + x ₀₁ , y ₀ + Δ y ₀ + y ₀₁)	
(x ₀ + Δ x ₀ + x ₀₂ , y ₀ + Δ y ₀ + y ₀₂)	
(x ₀ + Δ x ₀ + x ₀₃ , y ₀ + Δ y ₀ + y ₀₃)	
(x ₀ + Δ x ₀ + x ₀₄ , y ₀ + Δ y ₀ + y ₀₄)	

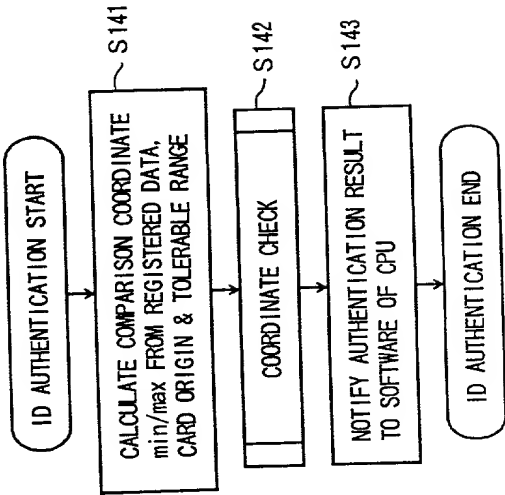


FIG. 20

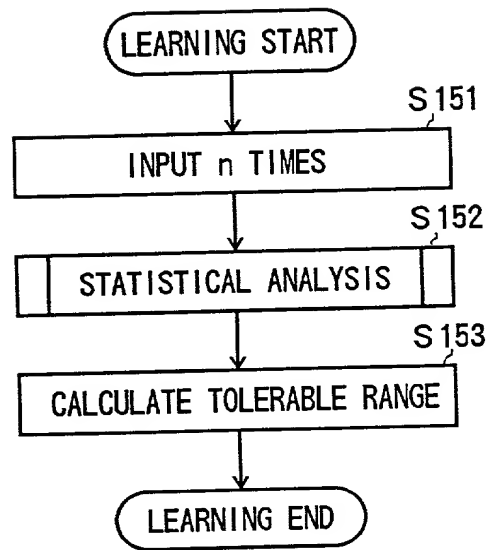


FIG. 21

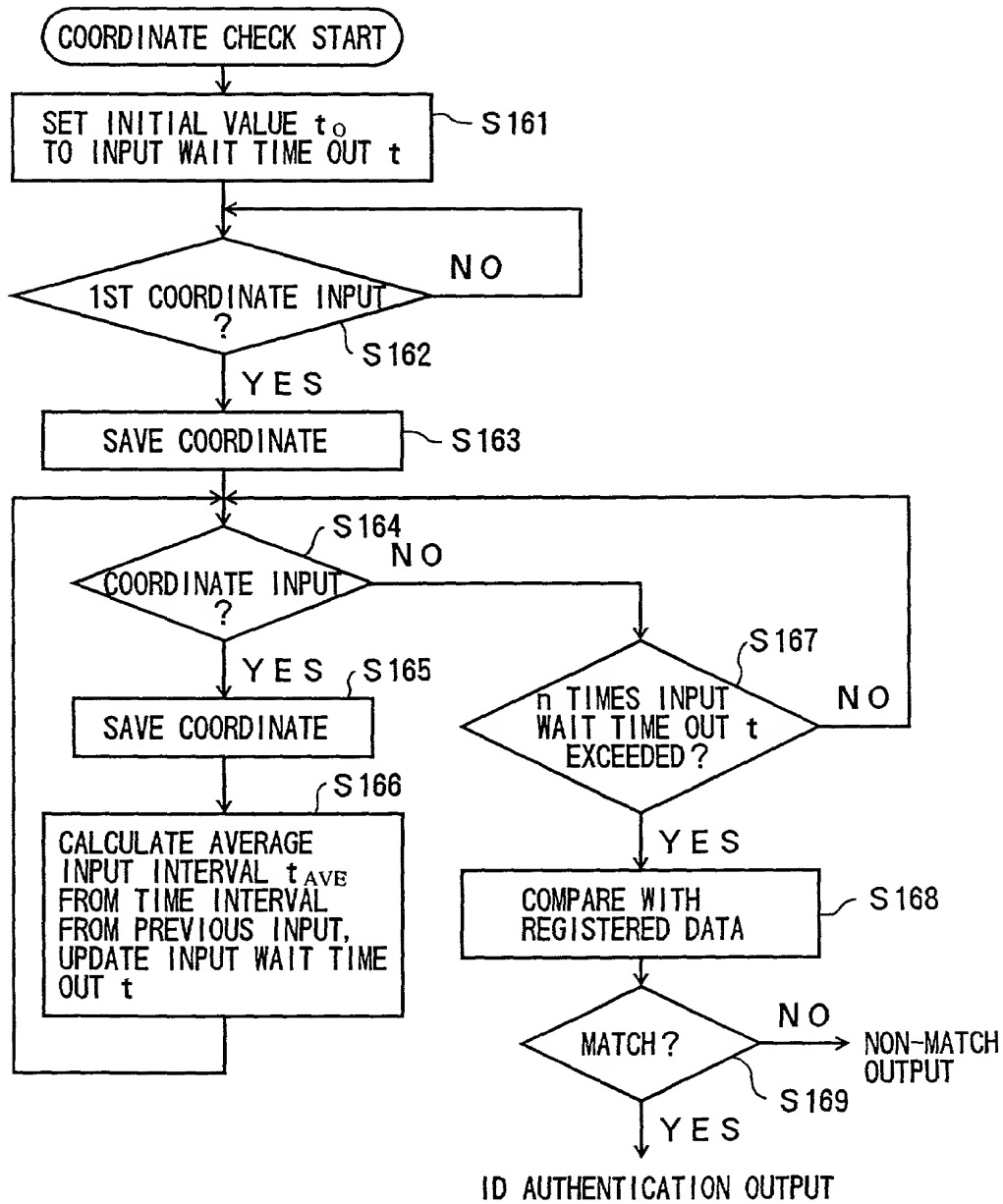


FIG. 22

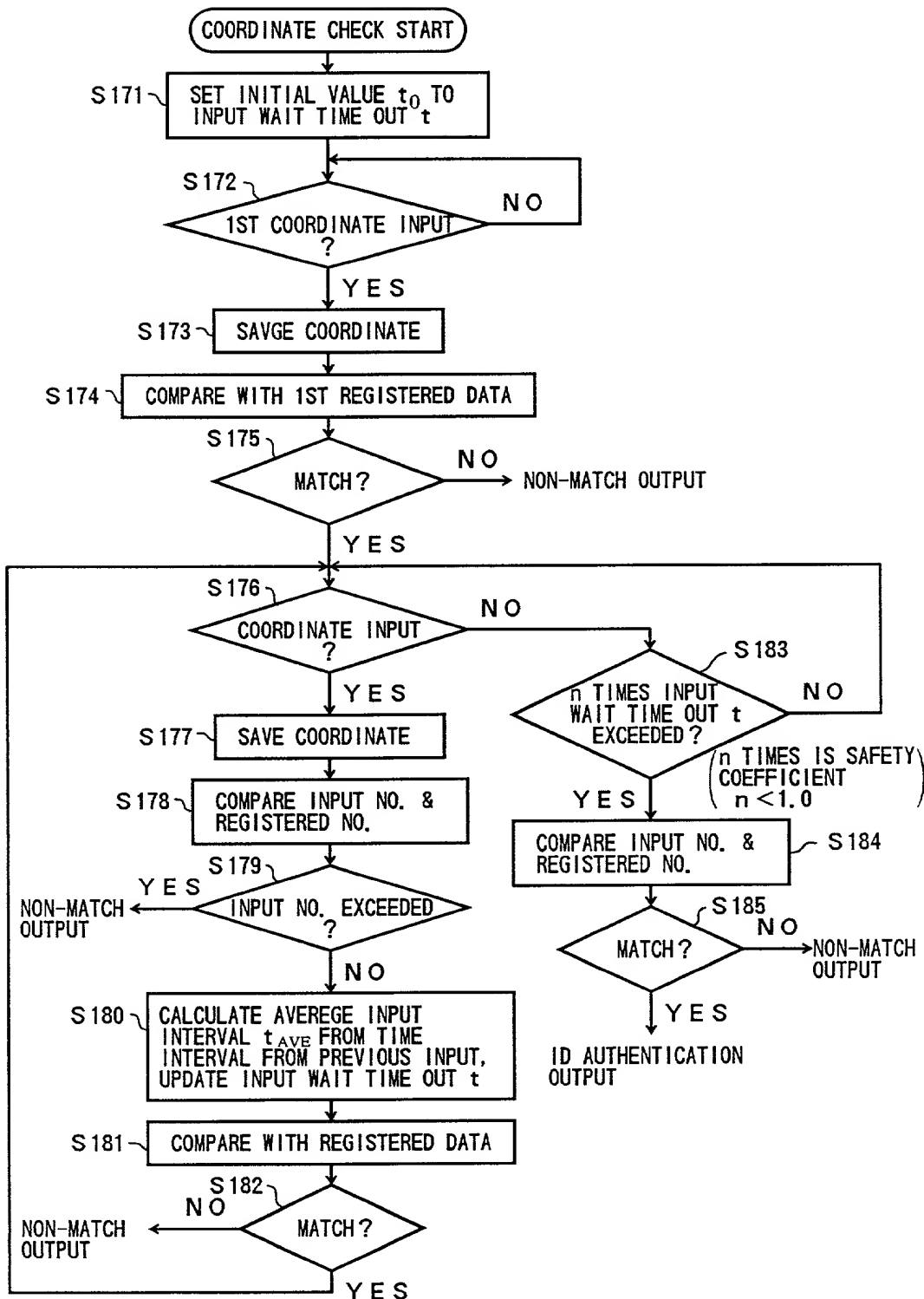


FIG. 23

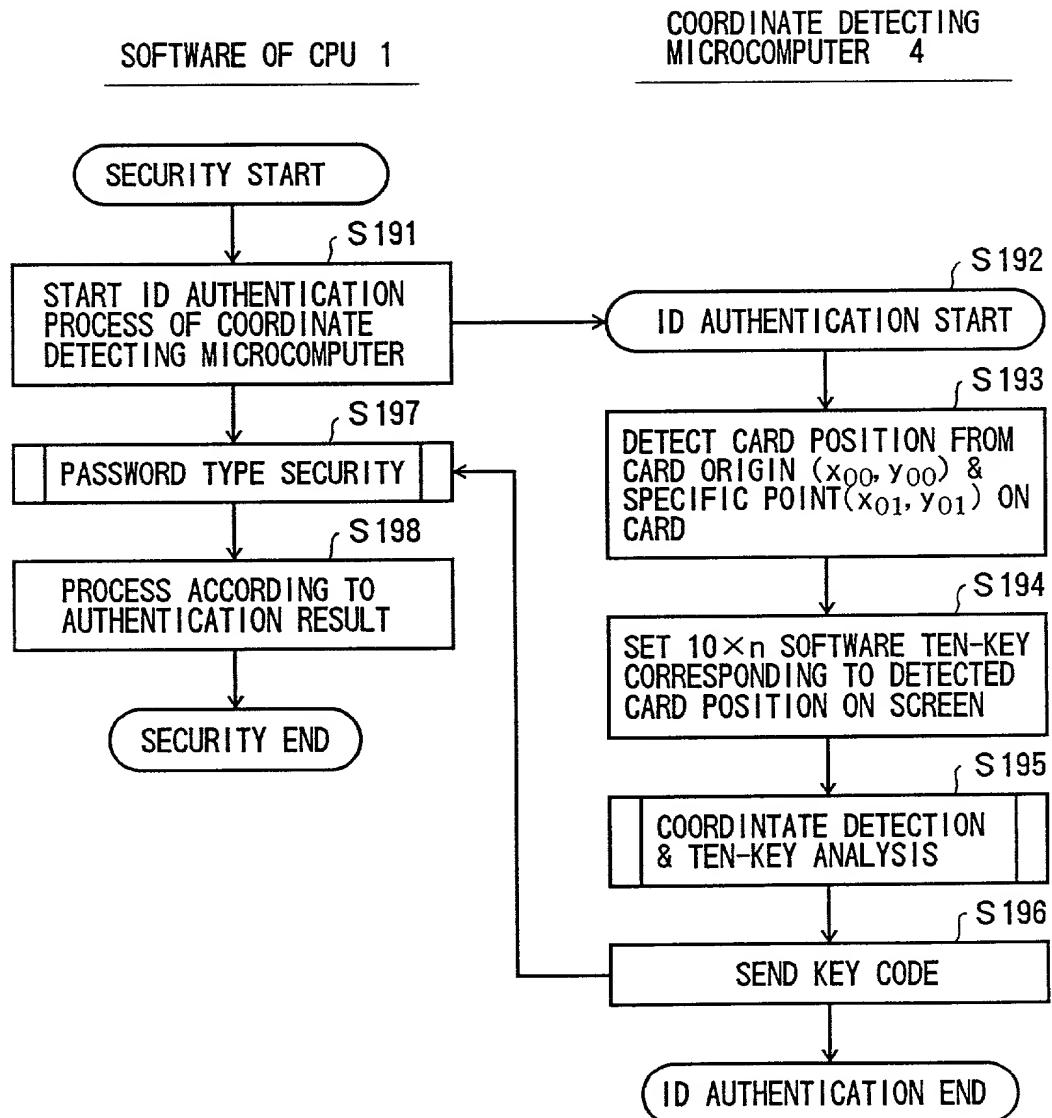


FIG. 25

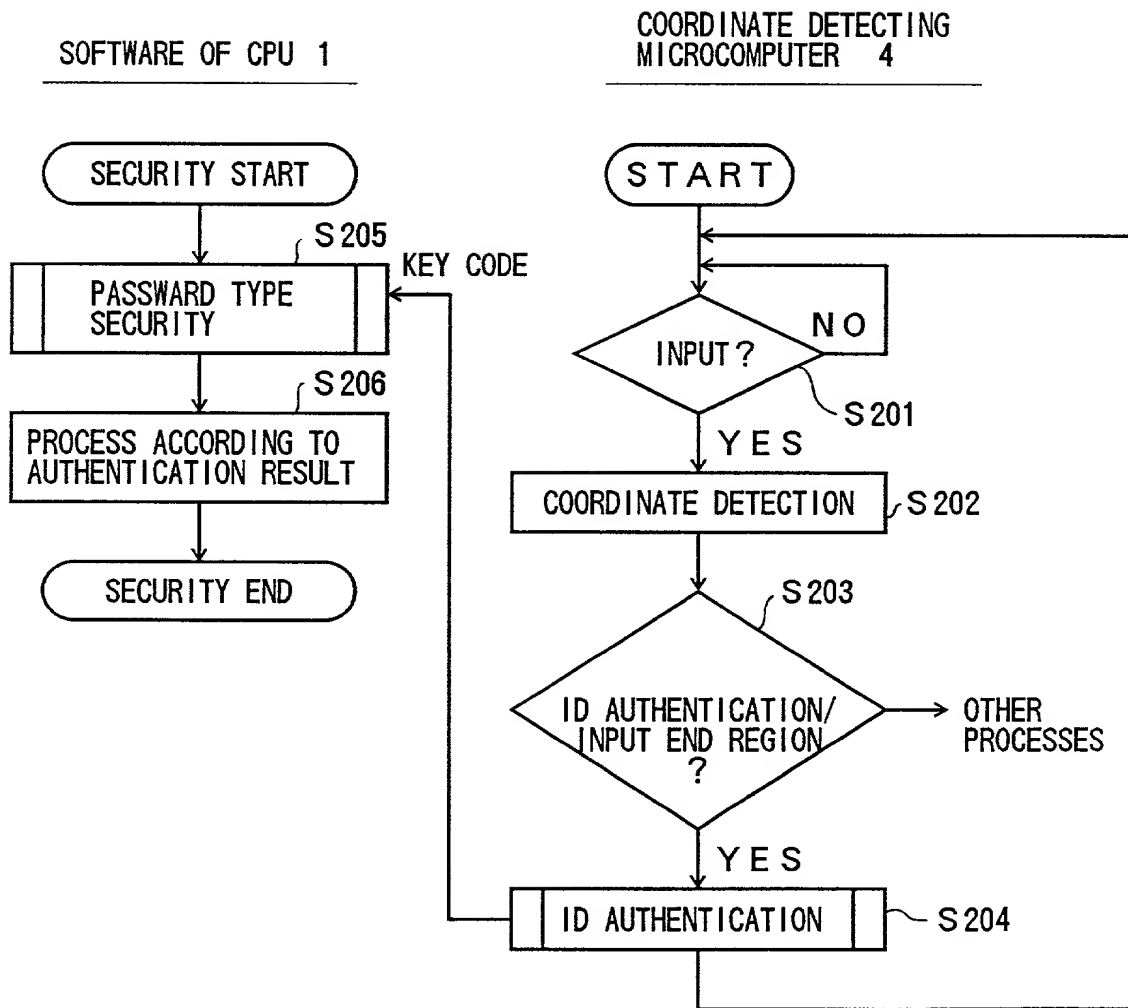


FIG. 26

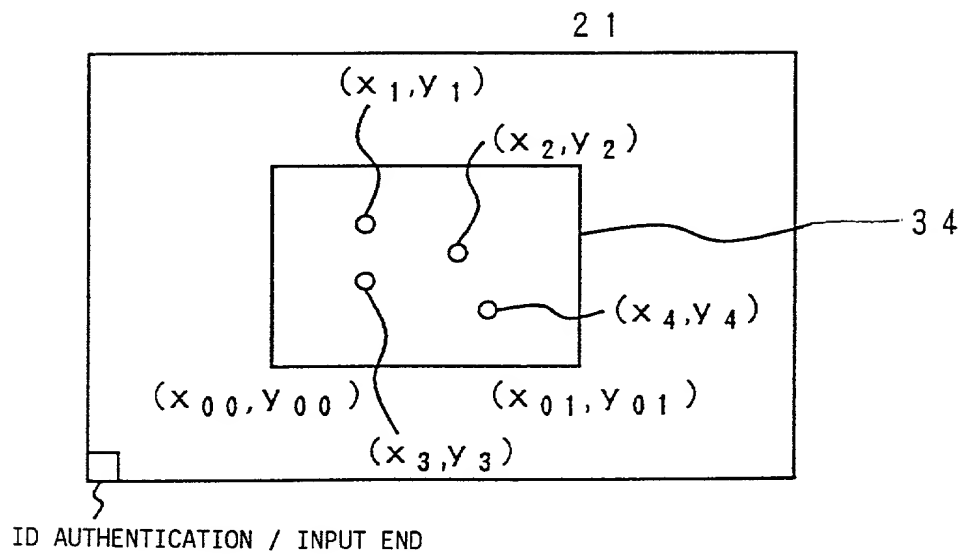


FIG. 27

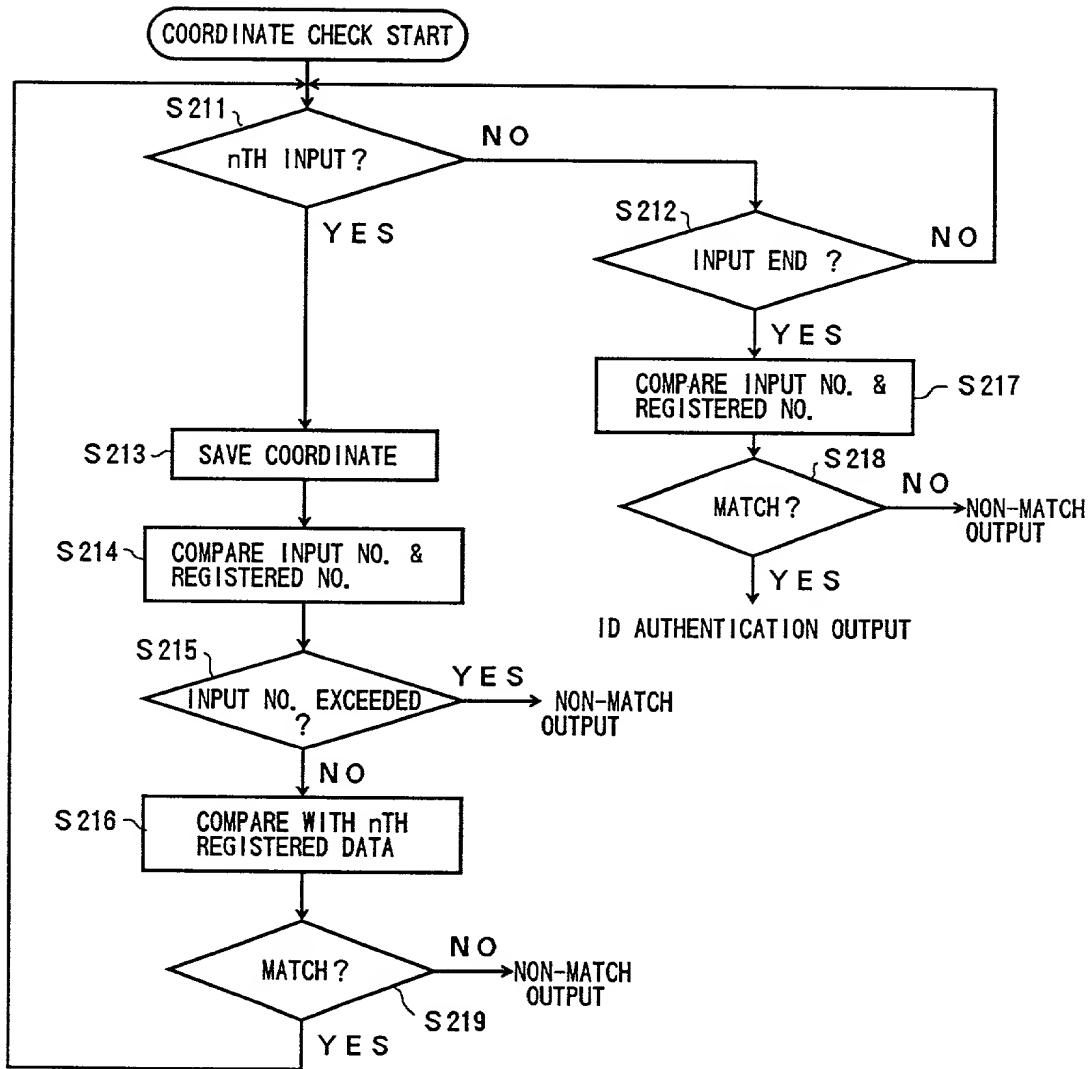


FIG. 29

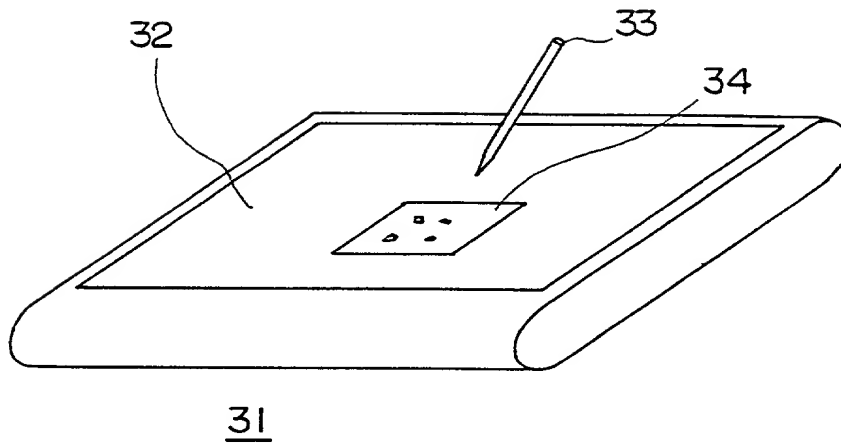


FIG. 30

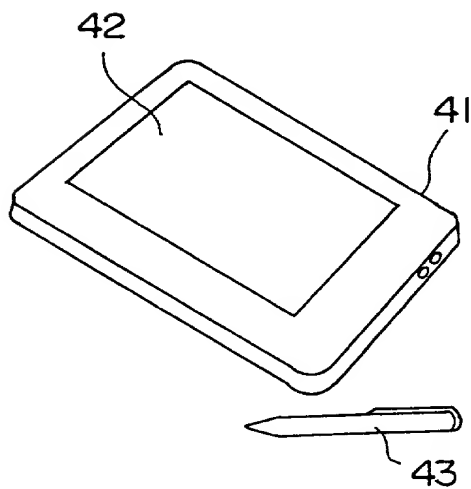


FIG. 31

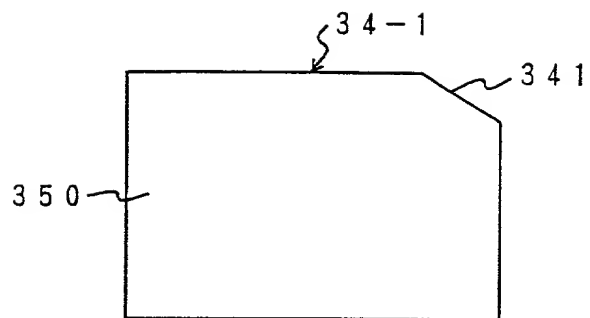


FIG. 32A

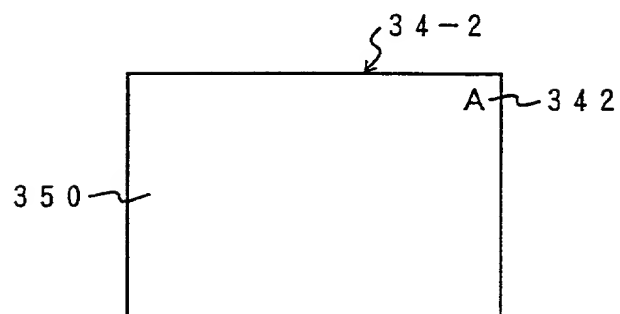


FIG. 32B

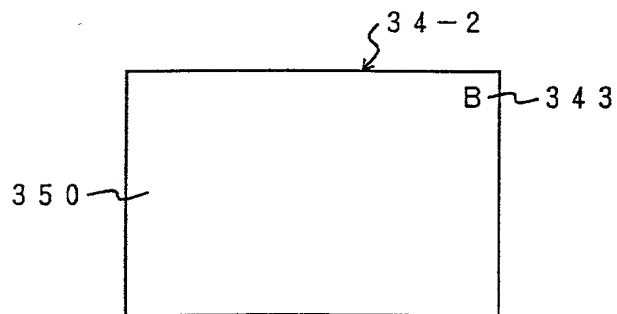


FIG. 33

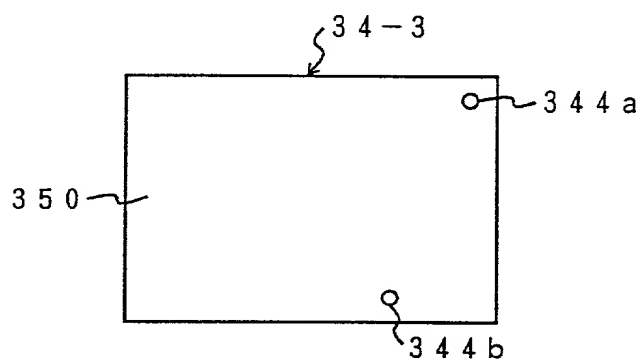


FIG. 34

